SOV/122-58-12-3/32

AUTHORS: Ignatenko, P.I., Candidate of Physical and Mathematical Sciences, and Terminasov, Yu. S., Doctor of Physical and Mathematical Sciences.

TITLE: Investigation of the Effect of the Surface Layer Condition in Steel on its Resistance to Wear (Issledovaniye vliyaniya sostoyaniya poverkhnostnogo sloya stali na yeye iznosostoykost')

PERIODICAL: Vestnik Mashinostroyeniya, 1958, Nr 12, pp 10-12 (USSR)

ABSTRACT: Rings of U8 carbon tool steel, of 48 mm o.d., 40 mm i.d., and 10 mm height were turned and annealed in an electric vacuum furnace. By grinding at different speeds (30 and 50 m/sec) deformations of different signs were introduced into the surface layer. Some of the sp ecimens were again annealed. The initial micro-hardness and surface finish were measured. Annealed specimens with 200 kg/mm^2 (high-speed grinding) were tested for wear on an Amsler machine, namely dry, under a load of 3 kg, and lubricated, under a load of 20 kg. Cast iron self-aligning blocks were pressed against the rotating rings. The wear was judged by the loss of weight. The degree of work-hardening

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SOV/122-58-12-3/32

Investigation of the Effect of the Surface Layer Condition in Steel on its Resistance to Wear

has proved to be the main factor determining wear. Fig 2 shows the friction work in lubricated slidings plotted against the number of revolutions. One curve covers all annealed specimens and another, about 20% lower, covers all work-hardened specimens. Fig 3 shows the micro-hardness rising with the number of revolutions and illustrates the rise of micro-hardness as the reason for the flattening out of the wear curves. Similar regularities were observed in dry friction. However, the final micro-hardness values, achieved after running-in (about 450 kg/mm^2) were about the same whatever the starting condition, whereas in lubricated friction the annealed specimens never reached more than 350 kg/mm^2.

There are 5 graphs and 4 Soviet references.

Card 2/2

SOV/58-59-8-17942

Translated from: Referativnyy Zhurnal Fizika, 1959, Nr 8, p 135 (USSR)

AUTHORS: Makogonov, V.Ye., Terminasov, Yu.S.

TITLE: An X-Ray Study of the Mechanism of Fatigue in Metals Possessing Crystals of Dissimilar Sizes

PERIODICAL: Tr. Leningr. inzh.-ekon. in-ta, 1958, Nr 23, pp 46-67

ABSTRACT: Al, Cu and commercial Fe with crystals of dissimilar sizes were studied by means of the Laue and reverse-exposure method. The samples were subjected to a bending of alternate sign. The samples of Al had crystals ranging in size from 10^{-4} to 5 cm and were subjected to the fatigue test at amplitudes of 1, 3 and 10 mm. In fine-crystalline samples at all test amplitudes distortions of the second type (crushing of the crystalline blocks and of crystallite deformations), which would have been manifested in the line width, did not arise during cyclical loading. For a crystal size of 10^{-2} cm a crushing of the crystalline blocks is observed, and their incidental disorientation can be discovered on the Laue diffraction patterns; however, crystallite deformations do not arise. For samples having crystalline grains of a size ranging from 1 mm to greater dimensions,

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SOV/58-59-8-17942

An X-Ray Study of the Mechanism of Fatigue in Metals Possessing Crystals of Dissimilar Sizes

crushing occurs without the development of crystallite deformations; furthermore, the greatest crushing takes place at the crystal boundaries. The above-mentioned process of deformation of the crystalline structure of Al (crushing of the blocks) reduces the sample to a condition of "friability", which is the cause of the metal's loss of endurance after the passage of a certain number of cycles. Unlike Al, few crystallite deformations arise in red Cu during the first period of cyclical loading. In other respects the process of the development of the fragmentation of crystalline blocks is analogous to the corresponding process occuring in the Al samples, with only this difference that a greater amount of crushing of the crystalline blocks, observable only in the pre-fracture period itself, takes place at the site of the sample's fatigue fracture. The samples of commercial Fe, subjected to cyclical loading, disintegrate in a manner analogous to that of the copper samples, and in the first test period small crystalline deformations arise in them. The development of crystalline deformations in the structure of metals is connected with the physical nature of the materials under investigation and can not serve as a structural indication of metal fatigue.

The author's conclusions

Card 2/2

GAL'PERIN, Ye.L, inzh.; TERMINASOV, Yu.S., doktor fiz.-mat.nauk, prof.

Radiographic examination of plastic deformations of steel.
Trudy LIEI no.23:68-79 '58. (MIRA 12:5)
(Steel--Testing)
(X rays--Industrial applications)

TERMINASOV, Yu.S.; YAR-MUKHAMEDOV, Sh.Kh.

X-ray investigation of fatigue in single aluminum crystals at normal and low temperatures. Trudy LIEI no.28:25-35 '58. (MIRA 13:4)
(Aluminum crystals--Testing) (Metallography)
(Metals, Effect of temperature on)

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SOV/58-59-7-15482

Translation from: Referativnyy Zhurnal Fizika, 1959, Nr 7, p 123 (USSR)

AUTHORS: Minin, L.P., Terminasov, Yu.S.

TITLE: X-Ray Diffraction Study of Aluminum Deformed by Stretching at Room Temperature and Low Temperature

PERIODICAL: Uch. zap. Leningr. gos. ped. in-ta im. A.I. Gertsena, 1958, Vol 141, pp 225 - 232

ABSTRACT: The authors studied the substructure of Al that had been deformed by stretching at temperatures ranging from 20° to -194°C. A special attachment made it possible to effect the deformation of the sample and obtain X-ray photographs both at room temperature and at low temperature (-194°C). The X-ray photography was effected by the reverse exposure method. It was established that there exists an interconnection between lattice distortions and the process of crushing of the blocks that takes place under plastic deformation. The increase of stresses in the initial stage of deformation paves the way for the process of crushing. The crushing of the blocks, as well as a certain disorientation that they

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SOV/58-59-7-15482

X-Ray Diffraction Study of Aluminum Deformed by Stretching at Room Temperature and Low Temperature

undergo, in turn promotes a further increase of distortions. It is probably the elastic stresses resulting from cooling that pave the way for the intensive crushing of the blocks that takes place when Al is deformed at low temperatures.

Card 2/2

SOV/137-59-7-15645

Translation from: Referativnyy zhurnal, Metallurgiya, 1959, Nr 7, p 208 (USSR)

AUTHORS: Pavlov, S.A., Terminasov, Yu.S.

TITLE: Roentgenographical Investigation on the Block Structure and Micro-deformations in 45 Grade Steel Subjected to Lubrication Friction

PERIODICAL: Uch. zap. Leningr. gos. ped. in-ta im. A.I. Gertsen, 1958, Vol 148, pp 261 - 263

ABSTRACT: Harmonic analysis of the shape of diffraction Roentgen reflexes was used to investigate deformations of the crystalline lattice in "45" steel surface layers; the steel was subjected to friction with lubrication under loads of 60 to 140 kg/cm^2. It was stated that heavier loads increased the depth of the cold-hardened layer and its microhardness. This process was accompanied by the crushing of blocks and the origination of microstresses in the cold-hardened layer. It was shown that deformations decreased at a remoter distance from the surface and at a depth of 250 μ (for loads of 120 kg/cm^2) the structure was not deformed.

A.B.

Card 1/1

SOV/126-6-5-24/43

AUTHORS: Mindukshev, V.F., and Terminasov, Yu.S.

TITLE: X-ray Investigation of Block Fragmentation and Distortion of the Atomic Lattice During Static and Dynamic Deformation of Metals at Normal and Low Temperatures (Rentgenograficheskoye issledovaniye fragmentatsii blokov i iskazheniy atomnoy reshetki v protsesse staticheskoy i dinamicheskoy deformatsii metallov pri normal'noy i nizkoy temperaturakh)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 6, Nr 5, pp 919 - 923 (USSR)

ABSTRACT: The basic factor influencing the changes taking place during static and dynamic deformation is that heat which arises along slip planes. The aim of the present work was to investigate static and dynamic compression of metals at room temperature and at liquid nitrogen temperature, using two metals of entirely different properties (duralumin and copper). The specimens (rods of 10 mm dia and 15 mm length) were annealed in vacuum and deformed in static and dynamic compression at room temperature and at liquid-nitrogen temperature. X-ray investigations of the crystal distortions and block fragmentation at static and dynamic deformation at the above temperatures were concerned with the broadening of the $K_{\alpha 1}$(511) and (422)

for duralumin and the (331) line for copper and the results are shown in Figure 1. In statically deformed duralumin a maximum broadening of the line (511) can be seen in specimens deformed and X-rayed at liquid-nitrogen temperature (Curve 1), particularly during the initial stages of deformation. The broadening of the (422) line as obtained by using an ionisation method, was also studied (see Figure 2). Comparing the dependence of broadening of interference lines in dynamically and statically deformed duralumin at various temperatures, a fundamental difference is evident which is shown in broadening of the line in relation to the type and temperature of deformation. The broadening of the line during plastic deformation is due on the one hand to micro-slip and on the other to fragmentation of blocks. In order to elucidate the reason for the great difference in the broadening of the line in relation to the type and temperature of deformation, the problem must be more closely considered. With the help of harmonic analysis, a division of the above effects

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X-ray Investigation of Block Fragmentation and Distortion of the Atomic Lattice During Static and Dynamic Deformation of Metals at Normal and Low Temperatures

could be obtained. The results obtained by this method show that lattice distortions at room temperature attain a value of 1.10×10^{-3} on statically compressed duralumin and 0.9×10^{-3} in dynamic deformation. Duralumin specimens deformed at the low temperature showed an internal stress of 1.20×10^{-3} for static and somewhat less for dynamic deformation. Hence, dynamic deformation at room temperature causes smaller micro-distortions of the crystal lattice than those which arise in static compression. This phenomenon can be explained by heat relaxation. Block fragmentation appears to occur because the stressed blocks can withstand only certain maximum stresses of the crystal lattice for a given metal, after which disruption into smaller blocks takes place. This is illustrated in Figure 3 in which the crystal block size is plotted against the degree of deformation for duralumin which had been deformed statically and dynamically at room temperature and at liquid-nitrogen temperature. The influence of the rate and temperature of deformation is also evident. At the low temperature, the influence of the

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SOV/126-6-5-24/43

X-ray Investigation of Block Fragmentation and Distortion of the Atomic Lattice During Static and Dynamic Deformation of Metals at Normal and Low Temperatures

rate of deformation becomes negligible. At room temperature relaxation increases and hence the influence of the rate of deformation is considerably greater. The stresses brought about by work hardening in compression are partly lowered by relaxation, particularly in dynamic compression. Hence, at the low temperature the micro-distortions attain a greater magnitude and the block size is nearly twice smaller as compared with the block sizes of specimens deformed at room temperature. There are 3 figures and 10 references, 5 of which are Soviet and 5 English.

ASSOCIATION: Leningradskiy inzhenerno-ekonomicheskiy institut (Leningrad Engineering-Economics Institute)

SUBMITTED: February 11, 1957

Card 4/4

MAMONTOV, Ye.A.; TERMINASOV, Yu.S.

X-ray investigation of the fatigue of steel. Izv. AN SSSR. Ser. fiz. 22 no.10:190-192 O '58. (MIRA 12:3)

1. Leningradskiy gosudarstvennyy pedagogicheskiy institut im. A.I. Gertsena.

(Steel--Fatigue) (X rays)

ANOSOVA, A.I.; TERMINASOV, Yu.S.

X-ray investigation of the fatigue of nonferrous metals. Izv. AN SSSR. Ser. fiz. 22 no.10:193-194 O '58. (MIRA 12:3)

1. Leningradskiy gosudarstvennyy pedagogicheskiy institut im. A.I. Gertsena.
(Nonferrous metals--Fatigue) (X rays)

AUTHORS: Mindukshev, V.F., Terminasov, Yu.S. 32-24-4-50/67

TITLE: A Device for Testing Samples With Respect to Static and Dynamic Compression at Low Temperature (Ustanovka dlya ispytaniya obraztsov na staticheskoye i dinamicheskoye szhatiye pri nizkoy temperature)

PERIODICAL: Zavodskaya Laboratoriya, 1958, Vol. 24, Nr 4, pp. 489-489 (USSR)

ABSTRACT: The system described makes it possible to attain static and dynamic compressions at constant test-temperatures in liquid nitrogen. It may be seen from the schematical drawing that the sample is between pressure plates of which the upper one is in a cylinder which regulates the amount of deformation, whereas the lower plate is fastened to the piston. The entire system is heat-insulated and is filled with liquid nitrogen; before being measured, the sample is left in it for 10 minutes, after which it is deformed in liquid nitrogen. The temperature of the sample is measured by means of a thermocouple during the process of determination, in which case one contact is on the surface of the sample and the other in the liquid nitrogen. In static tests the system is installed on the ball supports of the press, whereas in

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the case of dynamic tests it is fastened to the ram supports by means of screws. The ram should have a locking device for the purpose of intercepting the striker after the rebound caused by percussion. The deformed samples may be conveyed in a Deward vessel filled with nitrogen for the further investigation of a radiographic, metallographic or other kind. There is 1 figure.

ASSOCIATION: Leningradskiy inzhenerno-ekonomicheskiy institut (Leningrad Industrial Engineering Institute)

Library of Congress

1. Materials--Test methods 2. Materials--Testing equipment 3. Materials--Mechanical properties 4. Temperature--Control systems 5. Nitrogen (Liquid)--Applications

MINDUKSHEV, V.F.; TERMINASOV, Yu.S.

Apparatus for radiographic investigation at low temperatures.
Zav. lab. 24 no.5:641 '58. (MIRA 11:6)

1. Leningradskiy inzhenerno-ekonomicheskiy institut.
(Radiography)

TERMINASOV, Yu.S., doktor fiz.-mat. nauk, prof.; IGNATENKO, P.I., kand. fiz.-mat. nauk

Relationship between the wear resistance, microhardness, and crystal lattice distortion of metals. Vest. mash. 38 no. 8:45-46 Ag '58. (MIRA 11:8)

(Metals--Testing)

IGNATENKO, P.I., kand.fiz.-mat.nauk; TERMINASOV, Yu.S., doktor fiz.-mat. nauk

Investigating the effect of surface layer condition of steel on its wear resistance. Vest.mash. 38 no.12:10-12 D '58. (MIRA 11:12)

(Steel--Testing)

Terminasov, Yu. S.

24(7) 8.7.3.4 PHASE I BOOK EXPLOITATION SOV/3240

Leningrad. Inzhenerno-ekonomicheskiy institut

Primeneniye rentgenovykh luchey k issledovaniyu materialov (Application of X-Rays in the Study of Materials) [Leningrad] Izd-vo Leningradskogo univ., 1959. 125 p. (Series: Its: Trudy, vyp. 28) Errata slip inserted. 2,000 copies printed.

Ed. (Title page): Yu. S. Terminasov, Professor, and T. N. Smirnova, Docent; Ed. (Inside book): N. I. Busorgina; Tech. Ed.: S. D. Vodolagina.

PURPOSE: This book is intended for specialists and students in educational institutions working in x-ray analysis.

COVERAGE: This book contains 12 studies prepared by the staff of the Department of Physics and of other departments of the Leningrad Engineering and Economics Institute in cooperation with industrial enterprises. The studies deal with the fatigue of metals and alloys, wear of metals due to friction, and the state of surface layers of metals subjected to preliminary hardening.

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Application of X-Rays (Cont.) SOV/3240

The scientists applied the x-ray method of analysis to poly-crystalline metals and alloys, to single crystals of metals, and to tempered and surface hardened steel. Residual stresses due to thermal treatment (Type I) and grinding (Type III) are the subject of a special study with a view to their role in the development of surface cold-hardening and their influence on the grinding process. Considerable attention is paid to the force-feed metal-cutting method of V. A. Kolesov, and to a method of surface hardening of metals by shot blasting. References follow each article.

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Application of X-Rays (Cont.) SOV/3240

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AVAILABLE: Library of Congress

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2/18/60

TERMINASOV, Yu. S.; YARMUKHAMEDOV, Sh. Kh.

"X-ray Study of the Mechanism of the Fatigue in Metal Single Crystals at Room and Low Temperatures"

a report presented at Symposium of the International Union of Crystallography Leningrad, 21-27 May 1959

TERMINASOV, Yu. S.

PHASE I BOOK EXPLOITATION SOV/3618

Akademiya nauk Kirgizskoy SSR

Izvestiya. Seriya yestestvennykh i tekhnicheskikh nauk, tom 1, vyp. 1 (News. Series on Natural and Technical Sciences, Vol 1, No. 1) Frunze, 1959. 164 p. 500 copies printed.

Ed.: F.T. Kashirin; Tech. Ed.: M.G. Anokhina.

PURPOSE: This book is intended for research scientists and teachers in institutes of higher education who may be interested in developments and research trends in various scientific fields.

COVERAGE: The book contains 12 articles by persons affiliated with the Academy of Sciences Kirgiz SSR on studies in physical chemistry, industrial chemistry, applied physics (blasting dynamics), electric power engineering, electronics, agronomy, metallurgy, pure mathematics, etc. A bibliography of 1957 publications of the Academy includes works on history, archeology, economics, linguistics, literature, geology, biological sciences (botany, zoology, medicine), and technology. No personalities are mentioned. References accompany most of the articles.

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AVAILABLE: Library of Congress (Q 60.A516A2)

PHASE I BOOK EXPLOITATION SOV/3525

Alybakov, A., and Yu. S. Terminasov

Rentgenograficheskoye issledovaniye iskazheniy atomnoy kristallicheskoy reshetki v poverkhnostnom sloye metalla, podvergnutogo silovomu rezaniyu (X-Ray Investigation of Deformations of Atomic Crystal Lattices of Metal Surfaces Subjected to Machining at High Feed Rates) Frunze, 1959. 41 p. 500 copies printed.

Sponsoring Agency: Akademiya nauk Kirgizskoy SSR.

Ed.: G. A. Feklistov; Tech. Ed.: M. G. Anokhina.

PURPOSE: This book is intended for metallurgists, plant foremen and managers of metalworking plants, and metalworkers interested in more efficient techniques of machining metals.

COVERAGE: Referring to the wide use of a metal-cutting method called "power cutting" (i.e. machining at high feed rates) in the Soviet machinery-manufacturing industry, the author treats of metal-cutting process with a view to establishing optimum conditions for each case by considering the influences of such factors as crystal structure, physicomechanical

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properties, residual stresses caused by cutting, and especially, the influence of work hardening caused by power cutting. Power cutting stems from the development of a new cutting tool in 1953 by V. A. Kolesov. The investigations included x-ray analyses and microhardness measurements employing a device invented for the latter purpose by M. M. Khrushchov and Ye. S. Berkovich. There are 49 references: 42 Soviet, 4 English, and 3 German.

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SOV/163-59-1-29/50

18(3), 18(7)

AUTHORS: Myasnikov, Yu. G., Terminasov, Yu. S.

TITLE: X-Ray Structural Analysis of the Surface State of High-hardness Steels Subjected to Shot Peening (Rentgenograficheskoye issledovaniye sostoyaniya poverkhnosti staley vysokoy tverdosti pri drobestruynoy obrabotke)

PERIODICAL: Nauchnyye doklady vysshey shkoly. Metallurgiya, 1959, Nr 1, pp 151 - 159 (USSR)

ABSTRACT: This is an investigation of the effects of a discontinuous shot peening upon the surface structure of samples of 45KhNMFA and 60S2A steel. The samples were quenched in oil after having been kept at the hardening temperature for 10 minutes. The hardness of the samples after this heat treatment was 46-48 R_c (Rockwell C grade). This investigation was primarily directed towards a study of the dependence of the distortions of the crystal lattice of the surface layers and of the grain sizes in these layers upon a certain generalized parameter which was termed "density of shot

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X-Ray Structural Analysis of the Surface State of High-hardness Steels Subjected to Shot Peening SOV/163-59-1-29/50

peening" (Ref 3). This quantity represents the amount of shot striking unit surface of the sample during the consolidation period. The duration of treatment was chosen to be the variable factor in this investigation. The shot used was of 1 mm size, and it was thrown against the surface at a constant velocity of 81 m/sec, the duration of treatment varied from 1 - 7.5 minutes. The X-ray structural analysis was carried out on the URS-50I ionization apparatus. The interference lines (110) and (220) for three samples of each type of steel the X-ray diagrams of which were exactly identical, were analyzed. On the basis of the information gained the following can be stated: The distortions of the crystal lattice which are due to the heat treatment of steel 45KhNMFA are independently of the duration not modified by the shot peening treatment. The broadening of the interference lines is only ascribed to the reduction of the grain sizes. In steel 60S2A the lattice distortions during the first two minutes of treatment were found to proceed in correspondence with the reduction of grain size. Hence the process of crystal structure distortion may

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X-Ray Structural Analysis of the Surface State of High-hardness Steels Subjected to Shot Peening SOV/163-59-1-29/50

proceed along different lines, what depends upon the chemical composition of the steel and its thermal treatment. The difference detected may be investigated by means of the harmonic analysis. There are 3 figures, 2 tables, and 6 references, 4 of which are Soviet.

ASSOCIATION: Leningradskiy pedagogicheskiy institut (Leningrad Pedagogical Institute)

SUBMITTED: January 21, 1958

Card 3/3

TERMINASOV, Yu.S.; YAR-MUKHAMEDOV, Sh.Kh.

X-ray study of the deformation of the atomic crystal lattice of single crystals of aluminum, copper and Armco iron at room and low temperatures. Uch. zap. Kir. zhen. ped. inst. no. 4:29-50 '59. (MIRA 14:1)
(Crystal lattices) (Metals--Thermal properties)

SOV/129-59-5-4/17

AUTHORS: Yu.S. Terminasov, A.G. Yakhontov

TITLE: Influence of Grinding on the Distortions of the Crystal Structure of Metals (Vliyaniye shlifovaniya na iskazheniya kristallicheskoy struktury metallov)

PERIODICAL: Metallovedeniye i Termicheskaya Obrabotka Metallov, 1959, Nr 5, pp 19-23 (USSR)

ABSTRACT: The results are described of the influence of grinding regimes on the distortions in the structure of carbon steel U8 and commercial iron. The specimens were machined on a large grinding machine at various regimes. The grinding depths were 4, 10, 25, 37.5, 50 and 75 microns; the longitudinal feed rate of the table was 2.1, 3.9, 7.8, 13, 24 and 49 mm/rev. The machining speeds were 30 and 50 m/sec respectively. Investigations were carried out by the X-ray diffraction method and by the microhardness method. The structural distortions were evaluated from the changes in the widths and intensity of the interference lines. Microhardness measurements were also made; these enabled establishing the degree of hardness of the surface layers of the metal after machining. (The microhardness measurements were made by Cand. Tech. Sci. A.A. Matalin).

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SOV/129-59-5-4/17

Influence of Grinding on the Distortions of the Crystal Structure of Metals

On the basis of the obtained results, which are graphed and tabulated, it is concluded that the decrease in structural distortions in the surface layer in the case of fast methods of grinding is due to a decrease in the deformation forces and not to a softening effect caused by heat generation. Thus the depth of grinding is the most effective factor which regulates the thickness of the distorted layer (from 10 to 100 - 120 microns). The non-uniformities on the surface as well as a 10 micron thick layer adjacent to these, will become hardest. There are 7 figures, 1 table and 6 references, 5 of which are Soviet and 1 English.

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ASSOCIATION: Leningradskiy Inzhenerno-ekonomicheskiy Institut (Leningrad Engineering-Economics Institute)

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S/139/59/000/05/016/026
E091/E191

AUTHORS: Buyko, V.M., Makogonov, V.Ye., Terminasov, Yu.S., and Toropov, A.M.

TITLE: X-ray Study of the Mechanism of Fatigue in Ferrous and Non-Ferrous Materials and Alloys (Mono- and Poly-Crystalline Specimens)

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1959, Nr 5, pp 93-101 (USSR) (+ 1 plate)

ABSTRACT: The aim of this work is the elucidation of the following problems: 1) the reason for the broadening of interference lines in X-ray photographs of metals subjected to cyclic deformation; 2) whether the change in intensity of the X-ray lines can be used as a criterion for fatigue; 3) how does the fatigue process proceed in specimens of ferrous and non-ferrous alloys of different crystal sizes up to monocrystals, and 4) whether low temperature brings about changes in the structure of metals subjected to fatigue. The authors have submitted the following metals and alloys to fatigue tests: commercially pure iron (Armco iron), cuprite, aluminium, and brass. Brass specimens were tested first. These were cylindrical in shape. Various crystal sizes

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68873

S/139/59/000/05/016/026
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X-ray Study of the Mechanism of Fatigue in Ferrous and Non-Ferrous Materials and Alloys (Mono- and Poly-Crystalline Specimens)

were attained in these specimens by means of heat treatment. The latter were tested in a fatigue testing machine of the NU type at room temperature. One part of the specimens was tested in the annealed condition, the other part in a worked condition (work hardening was due to turning in a lathe). All tested specimens were subjected to deformation by bending to a definite degree at definite loads for different numbers of cycles. The second group of specimens was made from sheet material. The specimens were in the form of a uniform resistance beam or rectangular plate (Fig 1). One part of the specimens had a fine-grained structure (normal poly-crystalline specimens), the other part was submitted to preliminary working and subsequent recrystallisation which enabled crystals of different dimensions, from 10^{-3} mm to several cms, to be grown. For fatigue testing the authors built an apparatus in which specimens could be bent symmetrically. Its construction was based on the principle of constant deformation (Fig 2). In this

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machine the specimens were tested at amplitudes of 1, 3, and 10 mm. Testing of all the above specimens was carried out at normal temperatures as well as at liquid nitrogen temperature. The specimens were X-rayed by the back reflection method as well as by the Laue method. The significant portion of the polycrystalline specimens was X-rayed in an ionisation apparatus of the URS-50I type. Specimens submitted to testing at liquid nitrogen temperature were subsequently X-rayed at normal temperature. In order to be able to predetermine the place of fatigue fracture of these specimens during testing, their middle portion had a different diameter from those portions of the specimen which were close to the grips of the machine. By means of heat treatment the following crystal sizes were attained in brass specimens: 10^{-4} mm, 10^{-3} and 10^{-2} mm (vacuum annealed specimens). X-ray investigations of these specimens were carried out by the ionisation method. The investigation of finely crystalline specimens (with crystal sizes of

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10^{-4} mm) led to the following results. In the testing of these specimens at cyclic stresses of 14, 18 and 22 kg/mm^2, and different numbers of cycles, no secondary effects (broadening of interference lines) were observed. X-ray investigation of specimens of the second group (with crystal sizes of 10-3 mm), tested at the same cyclic stresses, exhibited a broadening of interference lines within limits of up to 1 million cycles (Fig 3). The third group of specimens (with crystal sizes of 10^{-2} mm), tested under the same cycle stresses, exhibited a broadening of interference lines within the limits of testing up to 3 million cycles. The maximum broadening of the lines was 20% as compared with the initial width of a non-deformed specimen (Fig 4). Figs 5 and 6 show the dependence of the intensity of the (511) line on the number of cycles at a cycle stress of 22 kg/mm^2 for crystals of 10^{-2} and 10^{-4} cm, respectively. Fig 7 shows the distribution of points in the specimen which were X-rayed. Fig 8 shows a Laue-graph of Al before, and

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Fig 9 after, fracture. Fig 10 is a Laue-gram for Armco iron. The physical mechanism of fracture of coarsely crystalline metals is the same for all the different metals investigated in this work. Specimens of the metals investigated, which were submitted to fatigue tests at liquid nitrogen temperature and then X-rayed at normal temperature, exhibited stronger distortions in their crystal structure. A comparison of the results of the investigation of fine grained metals with that of coarse grained ones, which essentially represent monocrystals, shows that the development of secondary effects (fragmentation of crystal blocks and crystal distortions) depends on the initial condition of the metal and is not a structural characteristic of fatigue. The change in line intensity, reflecting the development of tertiary distortions, signals the approach of fracture of the specimen, but for the time being it cannot be used as a universal criterion for fatigue, and further work in this direction is required. However, there is no doubt that

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X-Ray Study of the Mechanism of Fatigue in Ferrous and Non-Ferrous Materials and Alloys (Mono- and Poly-Crystalline Specimens)

the "disintegrations" in the metal structure appearing in fatigue testing are associated with dislocations which in their turn cause the development of tertiary distortions which, in a definite measure, are responsible for fracture.

There are 11 figures and 5 references, of which 4 are Soviet and 1 is English.

Card 6/6

ASSOCIATION: Leningradskiy inzhenerno-ekonomicheskiy institut (Leningrad Engineering-Economics Institute)

SUBMITTED: February 13, 1959

TERMINASOV, Yu.S.; TOROPOV, A.M.

Machine for the fatigue testing of flat specimens at room and low temperatures. Zav.lab. no.11:1381-1382 '59. (MIRA 13:4)

1. Leningradskiy inzhenerno-ekonomicheskiy institut.
(Fatigue testing machines)

BUYKO, V.M.; TERMINASOV, Yu.S.

X-ray study of the fatigue mechanism in annealed and prestressed steel. Trudy LIEI no.28:5-24 '59. (MIRA 13:4)

(Steel--Fatigue) (Metallography)

TERMINASOV, Yu.S.; YAR-MUKHAMEDOV, Sh.Kh.

X-ray investigation of the fatigue mechanism in single metal crystals at normal and low temperatures. Trudy LIEI no.28: 36-50 '59. (MIRA 13:4)
(Metal crystals--Testing) (Metallography)
(Metals, Effect of temperature on)

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S/058/61/000/001/006/008
A001/A001

18.8200
10.9220

Translation from: Referativnyy zhurnal, Fizika, 1961, No. 1, p. 315-316, # 1E311

AUTHORS: Terminasov, Yu. S., Toropov, A. M.

TITLE: X-Ray Examination of Distortions in Crystalline Structure of Steel 45 Aluminum and Red Copper Subjected to Fatigue Tests

PERIODICAL: "Tr. Leningr. inzh.-ekon. in-ta", 1959, No. 28, pp. 51-60

TEXT: The authors carried out fatigue tests of annealed specimens of Al, Cu and steel 45 (0.45% C) subjected to alternating bending at room temperature and that of liquid nitrogen. The X-ray examination was conducted with the ionization recording method and by harmonic analysis of the curves of intensities of X-ray interferences and by measuring integral intensity. It turned out that fatigue process in ferrous and non-ferrous metals was characterized by development of the domain structure, microdeformations and 3-order deformations. The part of each of these factors changes when conditions of fatigue testing alter. At a low temperature the part of the thermal effect is excluded, and distortions of crystalline structure manifest themselves in the most pronounced way. A great

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X-Ray Examination of Distortions in Crystalline Structure of Steel 45, Aluminum and Red Copper Subjected to Fatigue Tests

effect on intensity of interference lines is exerted by extinction which prevents the manifestation of 3-order deformations at initial phases of fatigue tests. The roentgenographic criterion of fatigue for annealed specimens can be employed only under conditions of fine-domain structure which excludes extinction effects.

L. Mirkin

Translator's note: This is the full translation of the original Russian abstract.

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88923
S/058/61/000/001/005/008
A001/A001

Translation from: Referativnyy zhurnal, Fizika, 1961, No. 1, p. 315, # 1E310

AUTHORS: Terminasov, Yu. S., Yar-Mukhamedov, Sh. Kh.

TITLE: X-Ray Examination of Aluminum Single Crystals Fatigue at Room and Low Temperatures

PERIODICAL: "Tr. Leningr. inzh.-ekon. in-ta", 1959, No. 28, pp. 28-35

TEXT: The authors studied fatigue of aluminum single crystals by the X-ray method of "increasing" interference spots. This method enables one to observe the changes in the fine structure of spots after each stage of testing. Alternating bending with various amplitudes was investigated at room temperature and that of liquid nitrogen. In the beginning of the room temperature test, an intense formation of domains in the crystal takes place. As the tension of the cycle grows, the process of granulation proceeds faster, dimensions of the domains formed increase, and granulation begins to prevail over plastic deformation of sliding. At low temperatures the increase of tension of the cycle produces the same effect as temperature rise at the constant tension of testing. An increase of fatigue

X

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A001/A001

X-Ray Examination of Aluminum Single Crystals Fatigue at Room and Low Temperatures

strength is observed with the temperature drop. The higher is tension of the cycle at low temperatures, the less an increase of durability in comparison with that at room temperature. Prior to fracturing, most spots on the roentgenogram are stretched into arcs and give rise to Debye rings. A possible mechanism of processes at alternating loading of a crystal is proposed and analyzed.

L. Mirkin

Translator's note: This is the full translation of the original Russian abstract.

Card 2/2

KARASHEV, T.; TERMINASOV, Yu.S.

X-ray investigation of residual 1st and 3d order stresses in the wear of steel specimens during the friction process. Trudy LIBI no.28:83-95 '59. (MIRA 13:4)
(Steel--Metallography) (Mechanical wear)

ABDULLINA, Z.M.; TERMINASOV, Yu.S.

X-ray investigation of the wear of metals having undergone a preliminary surface strengthening. Trudy LIEI no.28:96-104 '59. (MIRA 13:4)

(Metallography) (Mechanical wear)

S/137/60/000/011/031/043
A006/A001

Translation from: Referativnyy zhurnal, Metallurgiya, 1960, No. 11, p. 242, # 27174

AUTHORS: Myasnikov, Yu.G., Terminasov, Yu.S.

TITLE: Investigation of Shotblast Cold Hardening of Steel by the Roentgenographical Method

PERIODICAL: Tr. Leningr. inzh.-ekon. in-ta, 1959, No. 28, pp. 105 - 112

TEXT: An investigation was made with 60С2А (60S2A) and 45ХНМФА (45KhNMFA) steel. The method of Fourier's series and the analytical method were used to separate the effects of II order (fragmentation of domains and microdistortions of the lattice). It was established that in shotblast working microstresses increased in the surface layer when the shotblast time was extended. Etching-off surface strengthened layers revealed in a depth of 250 μ the presence of a layer where the magnitudes of microdistortions were by 25% less than on the sur-

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S/137/60/000/011/031/043
A006/A001

Investigation of Shotblast Cold Hardening of Steel by the Roentgenographical Method

face in the initial state; this is explained by partial annealing on account of heat liberated during shotblast treatment. It is established that the density of dislocations in the cold hardened layer is $3 \cdot 10^{11}$ cm^{-2}. This is the lowest possible limit of its magnitude. There are 11 references.

I.K.

Translator's note: This is the full translation of the original Russian abstract.

Card 2/2

ALYBAKOV, A.; TERMINASOV, Yu.S.

X-ray investigation of distortions in the crystal structure of the surface layer of metals under the effect of power cutting. Trudy LIEI no.28:113-124 '59. (MIRA 13:4)
(Metallography) (Deformations (Mechanics))

POLTAVSKIY, A.V.; TERMINASOV, Yu.S.

X-ray diffraction study of first-order residual stresses arising in the fine turning of metals. Izv. AN Kir. SSR. Ser. est. i tekh. nauk 1 no.3:45-50 '59. (MIRA 14:9)
(Turning) (Strains and stresses)

IMANALIYEVA, N.A.; TERMINASOV, Yu.S.

X-ray diffraction study of wear of brass. Izv. AN Kir. SSR. Ser. est. i tekh. nauk 1 no.3:51-58 '59. (MIRA 14:9)
(Mechanical wear) (Brass)

IGNATENKO, V.I.; TERMINASOV, Yu.S.

X-ray diffraction study of the mechanism of the plastic deformation of aluminum single crystals. Izv. AN Kir. SSR. Ser. est. i tekh. nauk 1 no.3:59-65 '59. (MIRA 14:9)
(X-ray crystallography) (Deformations (Mechanics))
(Aluminum crystals)

ZHOROBEKOV, Zh.; TERMINASOV, Yu.S.

X-ray diffraction study of relaxation in plastically deformed aluminum. Izv. AN Kir. SSR. Ser. est. i tekh. nauk 1 no.3:67-71 '59. (MIRA 14:9)
(X-ray crystallography) (Deformations (Mechanics)) (Aluminum)

AIYBAKOV, A.; TERMINASOV, Yu.S.

X-ray diffraction method for determining the density of dislocations in the surface layer of steel worked by turning. Izv. AN Kir. SSR. Ser. est. i tekh. nauk 1 no.3:73-76 '59. (MIRA 14:9)
(X-ray crystallography) (Steel)

KONYUK, M.M.; TERMINASOV, Yu.S.

Changes in the textured state of duralumin under alternating loading. Izv. AN Kir. SSR, Ser. est. i tekh. nauk 1 no.3:77-79 '59. (MIRA 14:9)

(Duralumin--Fatigue) (X-ray crystallography)

BUYKO, V.M.; TERMINASOV, Yu.S.

X-ray diffraction study of distortions of the crystalline structure of steels in fatigue tests. Izv. AN Kir. SSR. Ser. est. i tekh. nauk 1 no.3:81-103 '59. (MIRA 14:9)
(X-ray crystallography) (Dislocations in crystals)
(Steel--Fatigue)

TERMINASOV, Yu.S., prof.; TOROPOV, A.M., inzh.

X-ray investigation of the fatigue process in steel at room and low temperatures. Izv.vys.ucheb.zav.; chern.met. 2 no.7:75-78 Jl '59. (MIRA 13:2)

1. Leningradskiy inzhenerno-ekonomicheskiy institut. Rekomendovano kafedroy fiziki Leningradskogo inzhenerno-ekonomicheskogo instituta.
(Steel--Fatigue)

AUTHOR: Terminasov, J. S. CZECH/34-59-1-8/28

TITLE: X-ray Determination of the Crystal Structure of Metals During Static and Dynamic Deformation at Normal and at Low Temperatures (Rentgenografické zjišťování krystalické struktury kovů při statické a dynamické deformaci za normální a nízké teploty)

PERIODICAL: Hutnické Listy, 1959, 14, Nr 1, pp 43-47 (Czechoslovakia)

ABSTRACT: Paper presented within the framework of the Czechoslovak Metallurgical and Foundry Days, Pilsen, September 10-14, 1957. A number of authors (Refs 4,5, 14 and others) have pointed out that the mechanism of plastic deformation in the case of static loading differs from that pertaining to dynamic deformation of metals. The main factor affecting the changes which occur in both methods of deformation is the heat which is generated at the slip planes. The author considered it of interest to investigate the mechanism of plastic deformation in the case of dynamic and static loading under such conditions that the influence of the thermal factor is reduced to a minimum. The aim of the work described in this paper was to determine the static and dynamic compression of metals

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CZECH/34-59-1-8/28

X-ray Determination of the Crystal Structure of Metals During Static and Dynamic Deformation at Normal and at Low Temperatures

at room temperature and also at the temperature of liquid nitrogen on two metals with greatly differing properties (duralumin and copper). Deformation at low temperatures and comparison with normal conditions of deformation should enable determining the influence of the heat factor. The test specimens were of 10 mm dia. and a height of 15 mm, i.e. such that uniform compression could be achieved without bending. The specimens were machined on a lathe and then electrolytically polished. For the tests at room temperature a lubricant was used to reduce friction. To reduce the effect of work-hardening, the specimens were annealed in vacuum at 400 °C (duralumin), and 350 °C (copper) for a duration of 90 mins. Static deformation was effected on an Amsler type 60-ton press, whilst dynamic deformation was effected by means of a drop hammer weighing 8.5 kg and dropping from a height of 4 m. For deformation of the specimens at liquid nitrogen temperature a special test rig was used, a diagrammatic sketch of which is shown in

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CZECH/34-59-1-8/28

X-ray Determination of the Crystal Structure of Metals During Static and Dynamic Deformation at Normal and at Low Temperatures

Fig 1. The applied equipment enabled deformation to be effected at normal temperature as well as at low temperatures. The desired degree of deformation was achieved by using rings which limited the movement of the piston; the isothermal nature of deformation was ensured by providing good thermal insulation. The experimental results for duralumin are entered in the graphs, Figs 3-6. It was found that at room temperature dynamic deformation never causes such distortions in the crystal lattice as are caused by static compression. However, at very low temperatures the deformation speed has no influence. This is attributed to the fact that at room temperature dynamic deformation is an adiabatic process which leads to an increase in temperature and thus also to a partial elimination of distortions in the crystal lattice. However, at low temperatures the microscopic distortions are larger and the block dimensions are half the size of those of specimens deformed at room temperature. To a certain extent the results obtained have enabled

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CZECH/34-59-1-8/28

X-ray Determination of the Crystal Structure of Metals During Static and Dynamic Deformation at Normal and at Low Temperatures

detecting the nature of the differences between the static and dynamic deformation of metals and to determine the role of fragmentation of blocks and of microscopic (crystalline) distortions in the formation of the interference pattern obtained from X-ray diffraction analysis of metals deformed at room temperature and at the temperature of liquid nitrogen.
There are 8 figures and 16 references, 10 of which are English and 6 Soviet.

ASSOCIATION: Leningradský inženýrsko-ekonomický ústav, katedra fysiky (Leningrad Engineering Economic Institute, Physics Chair)

Card 4/4

S/148/60/000/003/007/018
A161/A029

AUTHORS: Buyko, V.M.; Terminasov, Yu.S.

TITLE: Roentgenographic Investigation of the Fatigue Mechanism of 35 KhNM Alloy Steel

PERIODICAL: Izvestiya vysshikh uchebnikh zavedeniy. - Chernaya metallurgiya, 1960, No. 3, pp. 73 - 77

TEXT: The mechanism of the fatigue process in carbon steel has been studied by roentgenographic means (Refs. 1, 2) but the recording of interference lines was not accurate enough for roentgenograms of alloy steel. The method used here included ionization and opened new possibilities. Chrome-nickel-molybdenum 35ХНМ (35KhNM) steel was chosen for investigation, and standard test specimens were prepared with a large-radius notch and one side of the notch was milled smooth. The beam of primary rays was aimed onto this surface. The specimens were annealed to remove work hardening. The fatigue limit of 35KhNM specimens was 39 kg/mm^2. The X-ray installation with ionization recording of the interference maxima was of the УРС-50 и (URS-50 i) type with a БСВИ (BSVI) tube with Fe-anode. Filtered K_α-radiation was used in all cases. The counter moved on a 160-mm radius circle during shooting. The X-ray beam was limited by two slit diaphragms placed between the

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S/148/60/000/003/007/018
A161/A029

Roentgenographic Investigation of the Fatigue Mechanism of 35 KhNM Alloy Steel

tube and the specimen and a third slit diaphragm with a filter was installed in front of the counter. A line (220) was fixed on the recording tape; the tape moved with constant velocity of 1,200 mm/hour. The width of interference lines was determined by the Stockes method (Ref. 3) and the size of blocks and micro-distortions of grid by harmonical analysis method (Ref. 4). The roentgenograms obtained from non-deformed specimens already had blurred interference lines characteristical for alloy steel and caused by some chemical non-homogeneity. It was concluded that the intensity of roentgen interferences can be considered a fatigue criterion, though the change of the line intensity at and above the fatigue limit is less sharp than in the case of carbon steel. There are 4 figures and 6 references: 5 Soviet, 1 English.

ASSOCIATION: Akademiya nauk Kirgizskoy SSR (Academy of Sciences of the Kirgizskaya SSR)

SUBMITTED: March 11, 1959

Card 2/2

82507

18.9200

S/070/60/005/004/007/012
E132/E360

AUTHORS: Sergeyeva, V.D. and Terminasov, Yu.S.

TITLE: X-ray Studies of the Distortion of the Structure of Steel on Working

PERIODICAL: Kristallografiya, 1960, Vol. 5, No. 4, pp. 580 - 584

TEXT: Changes of block size and the microstrains produced by rolling friction were investigated using Fourier analyses of the loading of the specimen, the friction path and the initial state. In addition the influence of the above mentioned parameters on the distortion of the crystal structure in the deformed surface layers at different depths was studied. It was shown that the process of plastic deformation of the surface layers under rolling friction is accompanied by the fragmentation of the crystalline blocks and by the increase of microstrains; development of these effects takes place simultaneously with the alteration in microhardness. The most developed of these structural characteristics were observed on the surfaces of the specimens in the first stage of testing. The intensity changes of some diffraction lines were studied and it was shown
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X-ray Studies of the Distortion of the Structure of Steel on Working

that part of these changes is due to the presence of texture (preferred orientation).
Fragmentation of crystalline blocks in annealed specimens grows with changing load up to 60 kg/mm^2 with later stabilisation. In specimens preliminarily cold-worked fragmentation also increases but stabilisation begins at less than 40 kg. Micro-strains in the crystal structure grow with increasing load both for annealed and for cold-worked specimens with the difference that for cold-worked specimens the growth of micro-strains ceases for less rigorous testing.
Fragmentation of the crystal blocks and the growth of micro-strains as a function of the duration of working is slight in the first hour and prolonged treatment produces little change. The greatest distortion of the structure is observed at the surface of the specimen and extends about 200 microns into the material. The changes in microhardness have the same character as the changes in the microstrains. The changes in the

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X-ray Studies of the Distortion of the Structure of Steel on Working

intensities of the X-ray lines cannot be fully ascribed to the development of third-order strains but depends also on the presence of textures in the surface layers of the specimen. There are 3 figures and 4 references: 1 Soviet, 2 international and 1 English. 4

ASSOCIATION: Leningradskiy inzhenerno-ekonomicheskiy institut (Leningrad Institute of Technology and Economics)

SUBMITTED: February 18, 1960

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ABDULLINA, Z.M.; TERMINASOV, Yu.S., red.; BEYSHENOV, A., tekhn.red.

[X-ray investigation of the wear resistance of steel]
Rentgenograficheskoe issledovanie iznosostoikosti stali.
Frunze, Kirgizgosizdat, 1961. 144 p. (MIRA 17:2)

S/137/62/000/006/141/163
A057/A101

AUTHORS: Bazarbekov, N., Terminasov, Yu. S.

TITLE: Roentgenographic investigation of the structure of nickel coatings, obtained chemically, in abrasion

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 6, 1962, 94, abstract 6I597 ("KyrgSSR Ilimder Akad. kabarlary. Tabiyat taanu zhana tekhn. ser., Izv. AN KirgSSR. Ser. yestestv. i tekhn. n.", 1961, v.3, no. 1, 41 - 50, Kirgiz summary)

TEXT: To obtain Ni-P-coatings on 45 steel the following solution was used (in g/l): $NiSO_4$ 30, Na-hypophosphate 10, Na-acetate 10 - pH 4.5-5.5. X-ray patterns of the samples were obtained with an УРС-50И (URS-50I) device. The coating obtained by chemical nickel plating was amorphous. If this coating is heated the Ni-P-coating changes into a crystalline face-centered cubic structure. The complete transformation from the amorphous into the crystalline state occurs at a thermal treatment of 400°C which corresponds to the highest micro hardness of the Ni-P-coatings. At a temperature above 400°C starts the coagulation of the

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crystals. The fragmentation of crystal blocks at 400°C does not change with the load, and increases with the path of friction up to a value of the latter equal to 6,000 m. The fragmentation of blocks occurs at 500°C in the initial stage of abrasion at a load of 40 kg with subsequent stabilization. Micro-deformations of the crystalline structure increase with the load in all ways of thermal treatment, but at intensive thermal treatment the growth of micro-deformations stops at smaller testing loads. The growth of micro-deformations in dependence of the path of friction occurs up to 4,000 m. Further testing up to 10,000 m does not change this value. There are 6 references.

Ye. Layner

[Abstracter's note: Complete translation]

ZHOROBEKOV, ZH.; TERMINASOV, Yu.S.

X-ray diffraction study of the phenomenon of recovery in brass. Izv. AN Kir. SSR. Ser. est. i tekh. nauk 3 no.1:51-55 '61. (MIRA 14:7)

(Deformations (Mechanics)) (X rays--Diffraction) (Brass--Metallography)

S/137/62/000/006/107/163
A052/A101

AUTHORS: Zhorobekov, Zh., Terminasov, Yu.

TITLE: Radiographic investigation of temporary relaxation of plastically deformed copper

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 6, 1962, 35, abstract 6I210 ("Izv. AN KirgSSR. Ser. yestestv. i tekhn. n.", 3, no. 1, 1961, 57 - 61, Kirghiz summary)

TEXT: The change in the width B and intensity I of relfexes 331 and 420 obtained by a back radiography from a cold-rolled to 0 - 25% Cu, was investigated in relation to the relaxation time of samples at room temperature. The values of B and I of the reflexes were measured immediately after deformation and after 10 - 160 day ageing. A decrease of B and an increase of I of the reflexes of copper were observed during the first 20 - 30 days, after which these characteristics attain a certain value and stabilize. Samples deformed to a different degree of deformation have a different course of the change of I: the lower the degree of deformation the nearer the I value approaches, due to relaxation,

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Radiographic investigation of...

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A052/A101

its initial value in an undeformed state without, however, reaching it. The observed changes in B and I values are brought in connection with the decrease of stresses of II and III kind.

A. Babareko

[Abstracter's note: Complete translation]

Card 2/2

BUYKO, V.M.; TERMINASOV, Yu.S.

X-ray diffraction study of the mechanism of fatigue in brand 35KhNM alloy steel. Izv. AN Kir. SSR. Ser. est. i tekh. nauk 3 no.1:63-69 '61. (MIRA 14:7)
(Steel alloys--Fatigue) (X rays--Diffraction)

MAMBETAKUNOV, T.; TERMINASOV, Yu.S.

X-ray diffraction study of structural changes in prehardened brand 20Kh steel in fatigue tests. Izv. AN Kir. SSR. Ser. est. i tekh. nauk 3 no.1:71-75 '61. (MIRA 14:7)
(X rays--Diffraction) (Steel alloys--Fatigue)

IMANALIYEVA, K.A.; TERMINASOV, Yu.S.

X-ray diffraction study of distortions of the crystalline structure of steel induced by friction. Izv. AN Kir. SSR. Ser. est. i tekh. nauk 3 no.1:77-81 '61. (MIRA 14:7)
(Xrays--Diffraction) (Steel--Testing) (Friction)

89664

18.8200

S/149/61/000/002/013/017
A006/A001

AUTHORS: Terminasov, Yu.S., Toropov, A.M.

TITLE: Roentgenographical Investigation of the Crystal Structure of Non-Ferrous Metals Under Conditions of Alternate Loading at Room and Low Temperatures

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Tsvetnaya metallurgiya, 1961, No. 2, pp. 116 - 122

TEXT: Until the present, roentgenographical investigations of non-ferrous metals subjected to alternate loading were made at room temperatures (Ref. 1, 2). To exclude the effect of heat on the deformation of the crystal structure of the metal, the authors carried out tests at -196°C with aluminum and copper specimens. Roentgenograms were taken by the photographical and the ionization method. The specimens were subjected to fatigue tests at alternate loads in liquid nitrogen on a special device (Ref. 4) representing a hinged four-section mechanism with a crankshaft whose length could be varied to the required amplitude. Stepped tests were made at each amplitude. The photographical method and the processing of results obtained were analogous to these described in Reference 3. Radiographs were taken with a КРОС-1 (KROS-1) camera, using a БВСЛ (BVSL) tube with a copper

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Roentgenographical Investigation of the Crystal Structure of Non-Ferrous Metals Under Conditions of Alternate Loading at Room and Low Temperatures

anode mounted on a УРС-55 (URS-55) device. During exposure the specimens (an aluminum foil standard or an annealed copper specimen) were rotated. They were fastened by a special device assuring the incidence of the X-ray beam onto the same spot. Photometric readings were taken with a МФ-2 (MF-2) microphotometer. The line width of the K_α -dublet was determined by dividing the surface of the curve corresponding to the interference line by the maximum height of the curve. Changes in the width of the line indicated changes in the effects of second order. The surface of the K_α -dublet curve was taken as integral intensity of the line, when evaluating distortions of the third order, which were estimated by changes in the relation $\frac{I(hkl)}{I_{st}}$. When using the ionization method roentgenograms were taken with the aid of an X-ray apparatus with ionization recording of interference maxima. A БСВИ (BSVI) tube with a copper anode and filtrated K_α -irradiation were employed. The width of K_α -lines was determined according to Stokes (Ref.5); the components of K_α -dublets were separated by the Rechinger method (Ref. 6). The magnitude of crystal domains and microdistortions of the crystal lattice were

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determined by harmonic analysis. The experiments yielded the following results: Effects of the second order (fragmentation of crystal domains and micro-distortions) developed in the crystal structure of aluminum only at heavy loads (5 mm amplitude). It was established that the fatigue process of copper was accompanied by fragmentation of crystal domains, proceeding during the initial stage of the tests, and by a slight increase of micro-distortions. Deformations of the third order appear only after discontinuation of extinction effect on the intensity of the lines, although the development of these distoritions takes place probably at the beginning of deformation of the specimens; during the initial stage of tests, however, their effect on the intensity of the lines is superimposed by the effect of extinction. Fragmentation of crystal domains ends with the initial stage of the tests, and therefore the distortions of third order manifest themselves already at relatively early stages of the tests.

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Figure 1:

Dependence of the width of line (222) of aluminum on the number of cycles at 5 mm amplitudes and room temperature

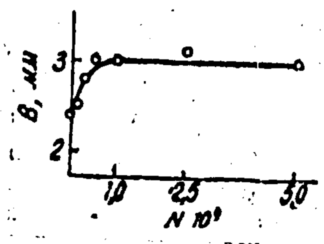

Figure 2:

Dependence of crystal domain sizes and microdistortions of aluminum on the number of cycles at 5 mm amplitude and room temperature

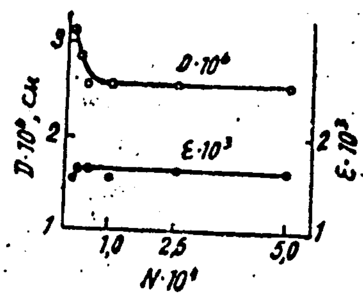

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Figure 3:

Dependence of crystal domain size and microdistoritions of copper on the number of cycles at 3 mm amplitude and room temperature

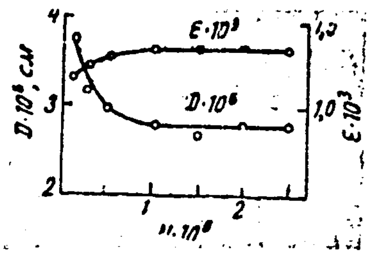

Figure 4:

Dependence of I/222/:I_{st} of aluminum on the number of cycles at 5 mm amplitude and room temperature

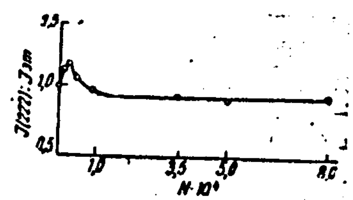

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Figure 5:

Dependence of I/511/:I_{st} of aluminum on the number of cycles at 5 mm amplitude and room temperature (Photographical method)

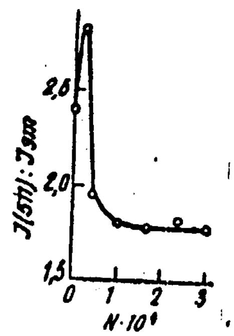
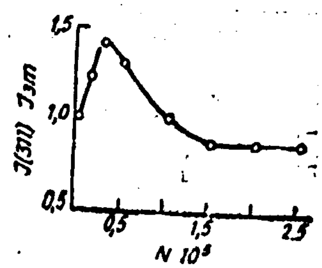


Figure 6:

Dependence of I/311/:I_{st} of copper on the number of cycles at 5 mm amplitude and room temperature



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There are 6 figures and 7 references: 5 Soviet and 2 Non-Soviet.

ASSOCIATIONS: Leningradskiy inzhenerno-ekonomicheskiy institut (Leningrad Economical Engineering Institute). Kafedra fiziki (Department of Physics)

SUBMITTED: May 19, 1960

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KUZNETSOV, A.V.; TERMINASOV, Yu.S.

Theory of X-ray scattering by mosaic crystals. Kristallografiia 6 no.2:177-183 Mr-Ap '61. (MIRA 14:9)

1. Petrozavodskiy gosudarstvennyy universitet.
(X rays--Scattering) (Crystals)

S/057/61/031/003/018/019
B125/B209

AUTHORS: Kuznetsov, A. V., Terminasov, Yu. S.

TITLE: Consideration of secondary extinction

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 3, 1961, 383-386

TEXT: The authors derive formulas for the integral reflection of a massive specimen, taking into account secondary extinction and assuming the mosaic blocks to have equal axes and equal probability of orientation. On the same assumptions they derive the thickness of the elementary layer as a function of the block size. In this case, the secondary extinction of this layer is supposed to be negligible. A correction for secondary extinction has to be introduced if in every column of mosaic blocks in the direction of the primary beam at least two blocks are aligned in reflecting position. When the blocks are large and the probability that they are aligned in reflecting position is the same in every column, one single block may appear in the center if the effect of secondary extinction vanishes. In the case of smaller blocks, m blocks in reflecting position may appear in every column. In each case, the entire volume of the speci-

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men may be divided into m layers, and in each of these layers the effect of secondary extinction may be assumed to be of the same intensity. The authors examined the diffraction at a thick polycrystalline plate. The angle between the primary beam and the plate surface is denoted by α; β denotes the corresponding angle for the diffracted beam. The total energy scattered from the first layer into all rings of volume dV amounts to $\sum P_1 = \frac{1}{2}\dot{I}_0 pQ\cos\vartheta_0 dV$. In the present paper, the same notations as in the paper of P. James, Opticheskiye printsipy difraktsii rentgenovskikh luchey, IL, M., 49, 1950, are used. Here and henceforward, the summation sign without any indices denotes summation over all Debye-Scherrer rings. In the case of a massive specimen, the number of elementary layers may be assumed to be infinite. For that case,

$$\frac{P}{I} = \frac{pQ\cos\vartheta_0}{2\mu\left(1+\frac{\sin\alpha}{\sin\beta}\right)} \frac{1-\exp\left[-\mu\left(1+\frac{\sin\alpha}{\sin\beta}\right)\frac{dz}{\sin\alpha}\right]}{1-\left[1-\frac{1}{2}(\sum pQ\cos\vartheta_0)\frac{dz}{\sin\alpha}\right]\exp\left[-\mu\left(1+\frac{\sin\alpha}{\sin\beta}\right)\frac{dz}{\sin\alpha}\right]}. \quad (7) \qquad (7).$$

In the calculation of the energy falling upon the short region 1 (which is short with respect to the radius r of the ring) of the entire ring, Eq. (7) has to be multiplied by

$$\frac{1}{2\pi_r \sin 2\vartheta_0}:$$

$$\frac{P}{I} = \frac{pQl}{8\pi\mu r \sin\vartheta_0\left(1+\frac{\sin\alpha}{\sin\beta}\right)} \frac{\exp\left[\mu\left(1+\frac{\sin\alpha}{\sin\beta}\right)\frac{dz}{\sin\alpha}\right]-1}{\frac{1}{2}(\Sigma pQ\cos\vartheta_0)\frac{dz}{\sin\alpha}+\exp\left[\mu\left(1+\frac{\sin\alpha}{\sin\beta}\right)\frac{dz}{\sin\alpha}\right]-1}. \quad (8) \qquad (8).$$

When small blocks are considered, the expression

$$\frac{P}{I} = \frac{pQl}{8\pi r \sin\vartheta_0\left[\mu\left(1+\frac{\sin\alpha}{\sin\beta}\right)+\frac{1}{2}\Sigma pQ\cos\vartheta_0\right]}. \qquad (14),$$

instead of Eq. (8), holds for the dependence of the integral intensity on the block size, when secondary extinction is taken into account (when $P_1 = \frac{1}{2}\dot{I}_0\, pQ\cos\vartheta_0\, dV$ (1)). Eq. (14) may be regarded as a limit which, in the case of strong granulation of the blocks, is approached by the integral intensity. Secondary extinction lowers the integral intensity to a considerable extent, if

$\mu\left(1+\frac{\sin\alpha}{\sin\beta}\right)$ is of the same order of magnitude as $\frac{1}{2}\sum pQ\cos\vartheta_0$. This is probably the case only with hard radiation and weakly absorbing media. But even for an Mo radiation,

$\mu\left(1+\frac{\sin\alpha}{\sin\beta}\right) \sim 27\ \mathrm{cm}^{-1}$, $\frac{1}{2}\sum pQ\cos\vartheta \sim 0.6\ \mathrm{cm}^{-1}$ holds for an Al sample when $\alpha = \vartheta_0$. The effect of secondary extinction for any size of the mosaic blocks is only weak if the quantity $\frac{1}{2}\sum pQ\cos\vartheta_0$ may be neglected as compared to $\mu\left(1+\frac{\sin\alpha}{\sin\beta}\right)$. For Mo radiation and an Al sample, the condition

$$\mu\left(1+\frac{\sin\alpha}{\sin\beta}\right)\frac{dz}{\sin\alpha} < 0.1, \qquad (13)$$

(13)

holds up to a size of the mosaic blocks of about 10^4 A. Thus, extinction

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does not change the ray intensity when the size of the blocks is about 10^{-4} A or less. The size of the elementary layer, in the case of an Al sample and Mo radiation is

$$\frac{dz}{\sin\alpha} = \frac{L^2}{\eta 40}(A).$$

This formula holds the more, the more mosaic blocks are present in an elementary column. Allformulas of the present paper were derived with regard to the secondary extinction in the primary cell. More accurate formulas for the case examined here will be given in a later paper. There are 1 figure and 1 Soviet-bloc reference.

ASSOCIATION: Petrozavodskiy gosudarstvennyy universitet (Petrozavodsk State University)

SUBMITTED: April 4, 1960

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S/057/61/031/006/019/019
B116/B201

24,7200(1144,1160)

AUTHORS: Kuznetsov, A. V. and Terminasov, Yu. S.

TITLE: Consideration of secondary extinction. II.

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 6, 1961, 757-759

TEXT: The formulas derived in the present paper take account of the effect of secondary extinction in a polycrystal with mosaic blocks uniformly distributed with respect to the angles of rotation taking multiple reflections into account. It is shown that existing formulas taking account of secondary extinction are not applicable in the case of small crystallite dimensions. The formulas derived in a previous paper by the authors (Ref. 1: ZhTF, 30, no. 10, 1960) take account of the effect of secondary extinction in the primary ray only (for a polycrystal with mosaic blocks uniformly distributed with respect to the angles of rotation). With small mosaic blocks, the integral reflection from a small, thick polycrystalline plate (Ref. 1) is given by

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$$\frac{P}{I} = \frac{plQ}{8\pi r \sin \vartheta_0 \left[\mu\left(1 + \frac{\sin \alpha}{\sin \beta}\right) + \frac{1}{2} \sum pQ \cos \vartheta_0\right]} \qquad (1)$$

To take multiple reflections into account, it is sufficient to take account of the attenuation of intensity due to extinction in the rays reflected from the various elementary layers as they emerge from the specimen. Further reflections will not play any role. According to the author's estimates, their contribution is considerably below the accuracy of existing methods of measuring the intensities. On the basis of similar considerations, the following formula is obtained for a polycrystal with mosaic blocks uniformly distributed with respect to the angles of rotation:

$$\frac{P}{I} = \frac{plQ}{8\pi r \sin \vartheta_0 \left(1 + \frac{\sin \alpha}{\sin \beta}\right)\left(\mu + \frac{1}{2} \sum pQ \cos \vartheta_0\right)} \qquad (2)$$

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With an aluminum specimen exposed to Mo radiation, the presence of a secondary extinction reduces the integral reflection of any interference by 4%. It is pointed out that many papers (not specified here) make use of formula

$$\frac{P}{I} = \frac{pQA(\vartheta)}{\mu + gQ} \qquad (3)$$

for taking secondary extinction in polycrystals into account. $A(\vartheta)$ is a factor depending on the geometrical conditions of the recording. In the authors' opinion, the application of formula (3) to a polycrystal, regardless of whether the latter is compact or powdery, is in no way justified with any crystallite dimensions. In fact, this formula is valid only if in each column the mosaic blocks of a single crystallite reflect X-rays. In other words, every ray is reflected only in the mosaic blocks of a crystallite, with the mosaic blocks being so weakly disoriented that none of them is reflected into any other ring (hkl). Under real conditions, however, everything will be more complicated. The authors have examined this problem more closely, namely, as applied to an aluminum specimen exposed to Mo irradiation. They made the following assumptions for the

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polycrystal: It consists of crystallites of random orientation; each crystallite consists of mosaic blocks which are not randomly oriented; all normals to the reflecting planes of the mosaic blocks are concentrated witin a small solid angle, and all mosaic blocks of the crystallite can be reflected into a Debye ring only. It was shown in a previous paper of the authors (Ref. 1) that in each column of a length $dz/\sin\alpha = L^2/740 \cdot Å$ (4), an aluminum specimen exposed to Mo radiation has, on the average, only a single crystallite (as in the present case) in the reflection position. The crystallite size is assumed to be $L = 10^3$ Å. The length of the elementary column will then be $1.3 \cdot 10^3$ Å. If the crystallites in the column are assumed to disperse, in which case the column size is equal to the half-absorption thickness of the layer every ray will be reflected from $3.5 \cdot 10^3$ crystallites. Formula (3) cannot be used in this case; in fact, if the crystallite is placed at some depth of the specimen, and not on its surface, the X-rays reaching the crystallite and those emerging from it will be weakened due to crystallites reflected into entirely different

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rings (hkl). In this case, formula (2) must be used in the crystallite consists of one mosaic block only. If, however, it consists of some weakly oriented mosaic blocks, the second term in the denominator of (2) has to be written as $g\frac{1}{2}\sum pQ \cos\vartheta_0$, where the coefficient $g > 1$ takes account of secondary extinction in the crystallites itself. Even if $L = 10^4$ Å, the ray will be reflected in 30 crystallites, and formula (3) will therefore be inapplicable here, too. Only if $L = 5\cdot10^4$ Å, each ray will be reflected in the specimen only once on the average. Formula (3) is applicable only with such and larger crystallite dimensions. If, however, the mosaic blocks of a crystallite are disoriented to a sufficient extent so as to be reflected into different rings, it is very doubtful even with large crystallites whether formula (3) may be applied. When using another radiation, the crystallite size beginning from which (3) may be used, varies. The lesser the penetration depth of X-rays, the smaller is the crystallite size for which (3) may be used. A more accurate analysis must be performed by using (4). The interpretation of effects of secondary extinction is most difficult in cases where each ray is reflected in some

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crystallites. Future calculations will show how things really are. [Abstracter's note: Essentially complete translation.] There is 1 Soviet-bloc reference.

ASSOCIATION: Petrozavodskiy gosudarstvennyy universitet (Petrozavodsk State University)

SUBMITTED: July 8, 1960

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ABDULLINA, Z.M.; TERMINASOV, Yu.S.

X-ray diffraction study of the wear of annealed 45 steel reinforced by preliminary surface treatment. Trudy LIEI no.29:5-13 [i.e. 39] '62. (MIRA 16:6)
(X-ray diffraction examination) (Steel--Testing)